

Amendments to the Claims:

This listing of the claims will replace all prior versions, and listings, of the claims in the application:

1 1. (Currently Amended) A method ~~for~~of detecting an incident ~~incidents~~ along a roadway,  
2 comprising the unordered steps of:  
3 arranging a plurality of readers at intervals along a roadway for reading uniquely  
4 identified data from each one of a plurality of vehicles;  
5 correlating the data with previously read data to obtain information ~~on~~regarding each one  
6 of the plurality of vehicles;  
7 determining the number of vehicles potentially affected by ~~incidents~~the incident along the  
8 roadway; and  
9 comparing the number of vehicles potentially affected by the incident ~~incidents~~ to a  
10 sample threshold.

1 2. (Original) The method of claim 1, wherein the plurality of readers comprises a plurality of  
2 traffic probe readers.

1 3. (Currently Amended) The method of claim 1, wherein each one of the plurality of readers is  
2 spaced at least five kilometers from an adjacent reader.

1 4. (Currently Amended) The method of claim 1, wherein the information regarding each one of  
2 the plurality of vehicles comprises ~~is~~ at least one of:  
3 a vehicle speed;  
4 an expected vehicle travel time for a vehicle to travel between two adjacent readers;  
5 ~~and/or~~  
6 an expected arrival time ~~of each of the plurality of vehicles~~ for a vehicle to arrive at one of  
7 the plurality of readers.

1 5. (Currently Amended) The method of claim 1, wherein the step of determining the number of  
2 vehicles potentially affected by ~~the~~an incident ~~further~~ comprises the step of determining ~~the~~an  
3 expected arrival time for each one of the plurality of vehicles to be detected by a particular one  
4 of the plurality of readers.

1 6. (Currently Amended) The method of claim 5, wherein the step of determining the number of  
2 vehicles potentially affected by ~~the~~an incident further comprises the steps of:  
3 determining ~~the~~an amount of time each one of the plurality of vehicles ~~vehicle time~~ is  
4 overdue past the expected ~~detection~~arrival time; and  
5 comparing ~~an~~the amount of time each one of the plurality of vehicles ~~vehicle time~~ is  
6 overdue to a predetermined threshold.

1 7. (Original) The method of claim 6, wherein the predetermined threshold is adjusted according  
2 to the roadway usage.

1 8. (Currently Amended) The method of claim 5, wherein the step of determining the number of  
2 each one of the plurality of vehicles potentially affected by ~~the~~an incident further comprises the  
3 steps of:  
4 determining ~~the~~an amount of time each one of the plurality of vehicles ~~vehicle time~~  
5 is ~~arrives~~ earlier than the expected ~~detection~~arrival time; and  
6 comparing ~~an~~the amount of time each one of the plurality of vehicles ~~vehicle time~~ arrived  
7 arrives early to a predetermined threshold.

1 9. (Original) The method of claim 8, wherein the predetermined threshold is adjusted according  
2 to the roadway usage.

1 10. (Currently Amended) The method of claim 1, further comprising detecting an incident in  
2 response to the number of ~~each of the plurality of vehicles~~ potentially affected by ~~the~~an incident  
3 exceeding the ~~predetermined~~ sample threshold.

1 11. (Currently Amended) The method of claim 10, wherein ~~each~~ some of the number of  
2 ~~plurality of vehicles~~ potentially affected by ~~the~~ an incident ~~are~~ is overdue at a particular one of the  
3 plurality of readers.

1 12. (Currently Amended) The method of claim 10, wherein ~~each~~ some of the number of  
2 ~~plurality of vehicles~~ potentially affected by ~~the~~ an incident ~~has arrived~~ arrive early at a particular  
3 one of the plurality of readers.

1 13. (Currently Amended) The method of claim ~~10~~ 12, wherein the number of ~~each of the~~  
2 ~~plurality of vehicles~~ potentially affected by ~~the~~ an incident is counted over a predetermined time  
3 interval.

1 14. (Currently Amended) The method of claim 4, wherein the expected arrival time of expected  
2 ~~readings~~ is a function of ~~the~~ a vehicle type.

1 15. (Currently Amended) The method of claim 1, wherein the plurality of readers ~~comprises~~  
2 comprise respective a transponder reader ~~readers~~.

1 16. (Currently Amended) The method of claim 1, wherein the plurality of readers ~~comprises~~  
2 comprise respective a license plate reader ~~readers~~.

1 17. (Currently Amended) The method of claim 1, wherein the determining the number of  
2 vehicles potentially affected by the incident comprises determining an instantaneous speed of  
3 ~~each~~ some of the plurality of vehicles ~~is determined by a Toll Gateway sensor~~.

1 18. (Currently Amended) The method of claim ~~5~~ 6, wherein the expected arrival time for each  
2 one of the plurality of vehicles ~~to be detected by reader~~ is calculated by:

$$ExpSpeed[V_i, S_j] = \min(StartSpeed[V_i, S_j], HighSpeed[S_j])$$

$$ExpTime[V_i, S_j] = \frac{Length[S_j]}{ExpSpeed[V_i, S_j]}$$

where,

$V_i$  is a vehicle entering a ~~road~~ roadway segment  $S_j$ ;

$ExpTime[V_i, S_j]$  = expected arrival time for the vehicle  $V_i$  ~~to be detected~~;

$StartSpeed[V_i, S_j]$  = starting speed of the vehicle  $V_i$  at the beginning of the roadway segment  $S_j$ ;

$ExpSpeed[V_i, S_j]$  = expected speed of the vehicle  $V_i$  over the roadway segment  $S_j$ ;

$HighSpeed[S_j]$  = average legal speed limit over the roadway segment ~~starting at~~  $S_j$ ; and

$Length[S_j]$  = length of the roadway segment ~~starting at~~  $S_j$ .

19. (Currently Amended) The method of claim 18, wherein an overdue time for each one of the plurality of vehicles ~~that has not been detected by the expected reader within the expected time~~, is calculated by:

$$Overdue[V_i, S_j, t_c] = \frac{t_c - StartTime[V_i, S_j] - ExpTime[V_i, S_j]}{ExpTime[V_i, S_j]} \times 100\%$$

where,

$StartTime[V_i, S_j]$  = time that the vehicle  $V_i$  entered the roadway segment ~~starting at~~  $S_j$ .

20. (Currently Amended) The method of claim 18, wherein a difference between the expected arrival time and an actual link segment travel time for each one of the plurality of vehicles is calculated by:

$$Diff[V_i, S_j] = \frac{\max\left(ActualTime[V_i, S_j], \frac{Length[S_j]}{HighSpeed[S_j]}\right) - ExpTime[V_i, S_j]}{ExpTime[V_i, S_j]} \times 100\%;$$

where:

$ActualTime[V_i, S_j]$  = actual segment travel time for the vehicle  $V_i$  to travel over the roadway segment  $S_j$ .

21. (Currently Amended) The method of claim 18, wherein the starting speed of the vehicle  $V_i$  at the beginning of the roadway segment  $S_j$  is calculated by:  $StartSpeed[V_j, S_j]$  = average speed of the vehicle  $V_i$  over a prior roadway segment.

22. (Currently Amended) The method of claim 18, wherein the starting speed of the vehicle  $V_i$  at the beginning of the roadway segment  $S_j$  is calculated by:  $StartSpeed[V_j, S_j]$  = instantaneous speed of the vehicle  $V_i$  at the start-beginning of the roadway segment of  $S_j$ , measured by a toll gateway speed sensor.

23. (Cancelled)

24. (Currently Amended) The method of claim 1, further comprising the step of excluding each a vehicle, that which is overdue for by more than a predetermined time cutoff threshold measured from a the time that the vehicle is initially overdue, from being ~~counted~~ included in the number of ~~each of the plurality of vehicles~~ potentially affected by ~~incidents~~ the incident.

25. (Currently Amended) The method of claim 1, further comprising the step of excluding each a vehicle, that which has arrived early at the end of a roadway segment for by more than a predetermined time cutoff threshold measured from a time that the vehicle is initially early, from being ~~counted~~ included in the number of ~~each of the plurality of vehicles~~ potentially affected by ~~the incident~~ incidents.

26. (Currently Amended) The method of claim 1, further comprising the step of suppressing the detection of ~~the an incident in a~~ along the roadway segment ~~when~~ where the number of vehicles exiting ~~the a segment of the roadway on an off-ramp over a predetermined interval of time~~ exceeds a predetermined threshold.

27. (Currently Amended) A method for detecting ~~an incidents~~ incident along a roadway, comprising the unordered steps of:

3 arranging a plurality of traffic probe readers at intervals along thea roadway for reading a  
4 respective transponder disposed on each one of a plurality of vehicles~~a vehicle~~;

5 correlating ~~the~~ transponder readings from each one of the plurality of vehicles ~~and with~~  
6 ~~expected readings from~~ associated with each one of the plurality of ~~vehicles~~ at more than one  
7 traffic probe reader to obtain at least one of a count of overdue vehicles or a count of early  
8 arriving vehicles; and

9 detecting the incident, ~~incidents which result~~ results in an interruption to the flow of  
10 traffic, in accordance with the correlating.

1 28. (Currently Amended) The method of claim 27, further comprising the step of writing time  
2 and location data into the transponder of each one of the plurality of vehicles.

1 29. (Currently Amended) The method of claim 27, further comprising the step of arranging a  
2 plurality of toll gateways at intervals along a roadway for reading a respective transponder ID  
3 from a respective transponder disposed on each one of thea plurality of vehicles and for  
4 determining the presence of vehicles not having a transponder-ID.

1 30. (Currently Amended) An incident detection system comprising:

2 a traffic management center processor connected to a data network;  
3 a plurality of unique vehicle data readers connected to said data network such that  
4 uniquely identified data are read from each one of a plurality of vehicles;

5 a correlation processor, wherein said uniquely identified data are correlated to obtain at  
6 least one of a count of overdue vehicles and or a count of early arriving vehicles; and

7 an incident detection processor coupled to the correlation processor and adapted to  
8 compare at least one of the count of overdue vehicles to a first sample threshold or and the count  
9 of early arriving vehicles to a second sample threshold.

1 31. (Currently Amended) The system of claim 30 wherein said plurality of unique vehicle data  
2 readers ~~further comprise~~ at least one of:

3 a plurality of traffic probe readers, each one of said plurality of traffic probe readers  
4 having ~~an automatic~~ a unique vehicle identification reader; ~~and~~  
5 a plurality of toll gateways, each one of said plurality of toll gateways having an  
6 ~~automatic~~ a unique vehicle identification reader.

1 32. (Currently Amended) The system of claim ~~31~~ 30 further comprising a plurality of roadside  
2 toll collection devices coupled to said plurality of toll gateways, coupled to said plurality of  
3 traffic probe readers, and coupled to said traffic management center, such that ~~the~~ a volume of  
4 data transmitted to said traffic management center is ~~minimized~~ reduced.

1 33. (Original) The system of claim 30 wherein said correlation processor is connected to said  
2 traffic management center processor.

1 34. (Currently Amended) The system of claim 30 wherein said correlation processor is  
2 connected to said plurality of unique vehicle data readers ~~roadside toll collection device~~.

1 35. (Original) The system of claim 30 wherein said incident processor is connected to said  
2 traffic management center processor.

1 36. (Currently Amended) The system of claim 30 wherein said incident processor is connected  
2 to said plurality of unique vehicle data readers ~~roadside toll collection device~~.

1 37. (New) The apparatus of claim 30, wherein said incident detection processor is further  
2 adapted to determine an amount of time each one of the overdue vehicles is overdue past an  
3 expected arrival time, and to compare the amount of time each one of the overdue vehicles is  
4 overdue to a predetermined threshold.

1 38. (New) The apparatus of claim 30, wherein said incident detection processor is further  
2 adapted to determine the amount of time each one of the early arriving vehicles is early with

- 3    respect to an expected arrival time, and to compare the amount of time each one of the early
- 4    arriving vehicles is early to a predetermined threshold.